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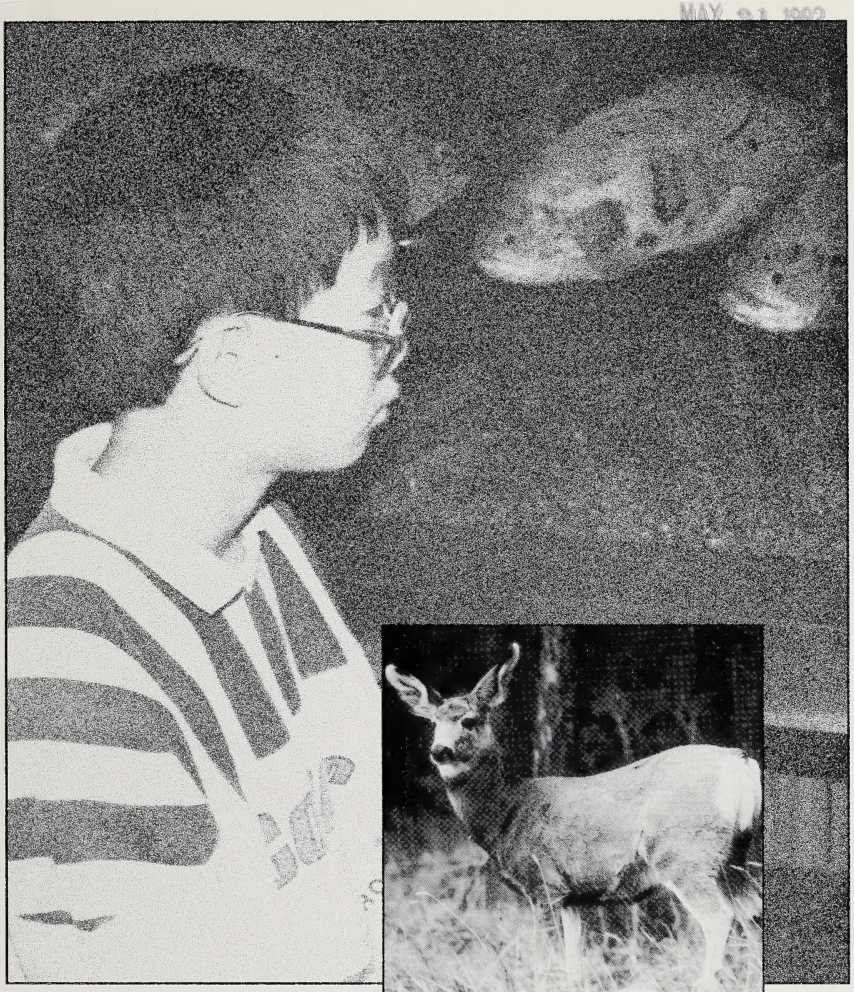

MODULE 6:

Interactions and Environments

Distance Learning

Alberta EDUCATION

Science 8

Module 6

INTERACTIONS AND ENVIRONMENTS

Alberta
EDUCATION

Science 8
Student Module
Module 6
Interactions and Environments
Alberta Distance Learning Centre
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Contents

OVERVIEW 1
Evaluation 2

SECTION 1:
LIVING THINGS AND NON-LIVING THINGS IN THE ENVIRONMENT 3
Activity 1: What Is in Your Backyard? 4
Activity 2: Abiotic Factors 6
Activity 3: Quadrat Sampling 14
Activity 4: Other Methods of Estimating Populations 16
Activity 5: Where Organisms Live 20
Follow-up Activities 23
Extra Help 23
Enrichment 25
Conclusion 27
Assignment 27

SECTION 2:
INTERDEPENDENCIES 29
Activity 1: Energy and Nutrients 30
Activity 2: Populations and Food Chains 37
Activity 3: Other Interactions Among Organisms 40
Activity 4: Niches, Habitats, and Specializations 44
Follow-up Activities 50
Extra Help 50
Enrichment 53
Conclusion 55
Assignment 55

SECTION 3:

THE ENVIRONMENT AND HUMAN ACTIVITIES 57

Activity 1: A Habitat on the Prairies 58

Activity 2: Pesticides and the Food Chain 62

Activity 3: The Effectiveness of Chemical Controls 65

Activity 4: Other Effects of Human Activities 68

Follow-up Activities 76

Extra Help 76

Enrichment 78

Conclusion 80

Assignment 80

MODULE SUMMARY 80

APPENDIX 81

Glossary 83

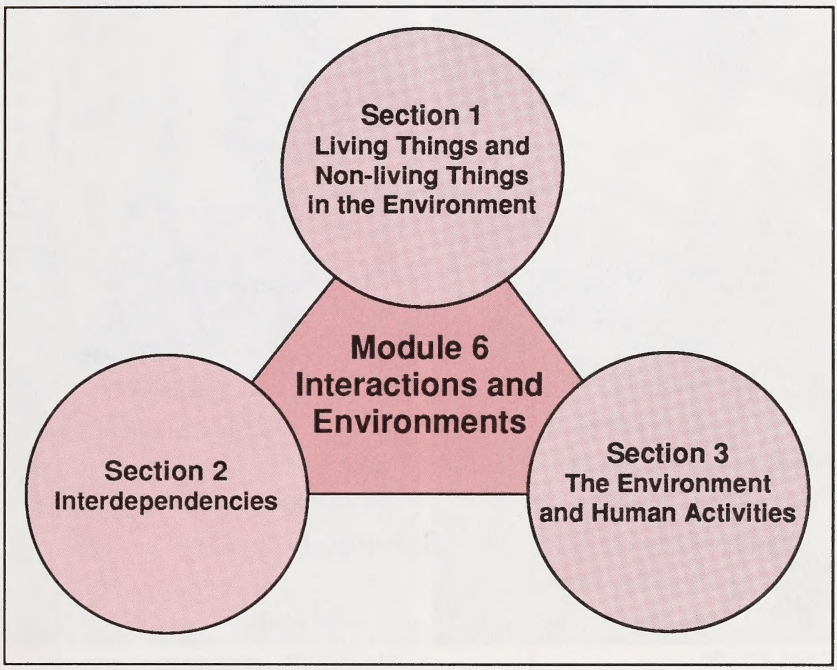
Suggested Answers 86

OVERVIEW

How is the whole world and all life on it like an aquarium or a machine?

Refer to pages 272 and 273 of *Science Directions 8* for an answer to this question and for an introduction to this module.

In this module you will identify living and non-living things in the environment. You will recognize the abiotic needs and the interdependencies of living things. You will also learn that human activities affect the environment.

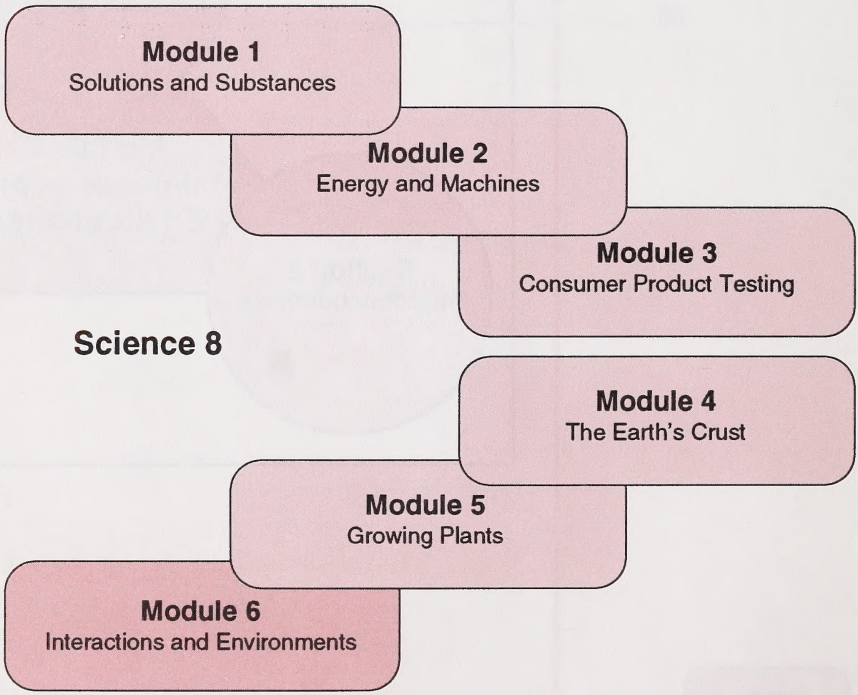


Evaluation

Your mark in this module will be determined by your work in the Assignment Booklet. You must complete all assignments. In this module you are expected to complete three section assignments.

The assignment breakdown is as follows:

Section 1 Assignment	**33%**
Section 2 Assignment	**42%**
Section 3 Assignment	**25%**
TOTAL	**100%**



Section

1

Living Things and Non-living Things in the Environment

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In some regions, such as a rain forest, living things seem to be everywhere. In other places, such as a mountain range, non-living things are more visible. You will learn that all environments have both living and non-living parts. You will be able to estimate populations of organisms, describe non-living parts of the environment, and recognize that temperature, soil, moisture, and light influence where plants and animals live.

Activity 1: What Is in Your Backyard?

Imagine you're on a space walk. Isn't it a thrill just floating in space as the world moves silently past you? You know that your spacesuit is very important to your survival in space; it provides you with the air you need to breathe and it keeps you warm. On Earth, your environment provides you with your needs.

Read pages 274 and 275 in your textbook to learn about the parts of an environment.

1. What are the biotic parts of the environment?

   _____

   _____

2. What are the non-living parts of the environment called?

   _____

3. Do question 1 (a) on page 287 of your textbook.

   _____

   _____

   _____

   _____

Check your answers by turning to the Appendix, Section 1: Activity 1.

You should now be able to identify biotic and abiotic parts of an environment. You are to study these parts of your backyard or some other area your learning facilitator finds suitable. Be sure your learning facilitator approves of the area of study.

4. Using Activity 6-1 on pages 276 and 277 of *Science Directions 8* as your guide, do the following from that activity.

Procedure

Textbook question 1:

Textbook questions 3. (a) and 3. (b):

Biotic	Abiotic

Finding Out

Textbook question 1:

5. Tell how one of the abiotic parts affects a biotic part of your backyard.

6. Pick a biotic part of your backyard that you would like to improve. How would you change your backyard to provide it with a better environment?

Check your answers with your learning facilitator.

Activity 2: Abiotic Factors

Levels of temperature, wind, moisture, and light are abiotic factors. Different organisms grow in different places because abiotic factors differ from place to place.

Read The Influence of the Abiotic Environment on pages 277 and 278 of your textbook to learn the importance of abiotic factors on living things.

1. Using the expression *range of tolerance* explain why a fern may die where a cactus can survive.

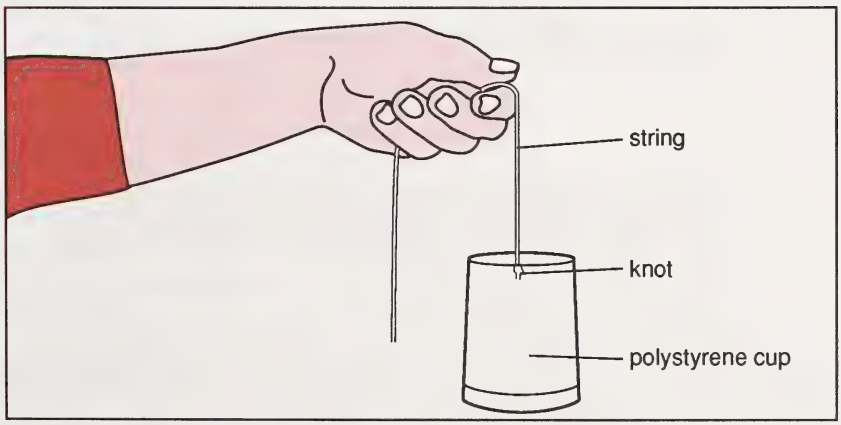
The abiotic factors are not the same throughout an area such as your backyard. You'll find this out by making measurements at various locations.

You will need the following:

- shovel
- hammer
- thermometer – alcohol-filled
- polystyrene cup or other light object to suspend in order to gauge wind speed
- string
- stake
- elastic or tape

You will be measuring levels of temperature, wind, sunlight, and soil moisture in various locations in your backyard or some other area your learning facilitator finds suitable.

To help you judge wind speed, suspend a polystyrene cup by a light string. Punch a small hole through the cup bottom and pass the end of the string through this hole. Put a knot in the string so that the end cannot get out. Hold the end of the string in your hand as shown. Release just enough string to allow the cup to move over a wide enough arc in response to the wind.



Use the following scale to measure wind speed.

Wind Speed	Description
none	• air is still • The suspended polystyrene cup does not move.
low	• slight breeze • The suspended polystyrene cup moves through a small angle.
moderate	• normal breeze • The suspended polystyrene cup moves through a larger angle – close to 45°.
gale	• very strong wind • The suspended polystyrene cup and string move to almost a horizontal position.

Use the following scale to indicate the amount of sunlight received in areas during the day.

Brightness	Description
sunny	• sunlight is not blocked • When it is sunny, objects cast shadows.
moderate	• partially blocked sunlight as by a trellis or the brightness on a cloudy bright day in an open area
shade	• the brightness of light in the shadow
darkness	• not observed directly • the brightness in a region that is covered, e.g., the region under a rock • can be indicated by roots that are white

In order to determine soil moisture in a soil sample, squeeze the soil into a ball. The soil is very moist if it stays together as a ball. It is moist if it stays together for the most part but falls apart slightly. The soil is dry if the soil does not stay together at all.

When measuring soil temperature, do not use the thermometer itself to make a hole. Use a stake or a spade to move the soil. The bulb should touch the soil for the most accurate readings.

If the thermometer has the bulb covered (by a housing), you can place the instrument in some thin plastic wrapping and then submerge it in the soil being measured. Wrapping it keeps it clean.

8 Science Directions

Refer to Activity 6-3 on pages 285 and 286 of *Science Directions 8*. Do steps 3, 4, and 5 of the procedure.

2. Record your results in the table.

Height	Temperature
30 cm above ground	
ground-level	
30 cm below ground	

3. At a suitable spot, record wind speeds at the heights indicated in the table. Pick a spot with low ground cover. Enter your results.

Height	Wind Speed
2 m	
1 m	
ground level	

Use your shovel to obtain samples of surface soil from where it is dry and where it is moist. Soil in the sun on the south side of a building will likely be dry. Expect moist soil in the shade. Use the squeeze test to determine moisture levels.

4. Enter your results in the table.

Location	Soil Moisture

Choose two spots with different light conditions.

Indicate the light conditions for the two locations using the brightness scale you read about earlier.

5. Enter your results in the table.

Location	Brightness

6. Pick your own test location and describe the abiotic factors of wind speed, brightness, temperature, and soil moisture that apply to it. Your test area could be in a shrub or under a rock, for example.

_____

_____

_____

_____

7. Give an example of how abiotic factors affect the growth of plants or animals in the area you studied.

_____

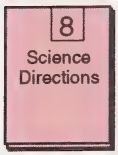
_____

_____

_____

Check your answers with your learning facilitator.

You have found that abiotic factors vary even in a small area. If you look at the prairie provinces, you can see large regions defined by abiotic factors.



The maps on page 279 of your textbook show annual hours of sunshine, annual precipitation, and general soil types for the prairie provinces.

8. Make a table to compare these factors for area A and area B on the map.

9. Do question 1 of Finding Out on page 279 of your textbook.

Textbook question 1. (a):

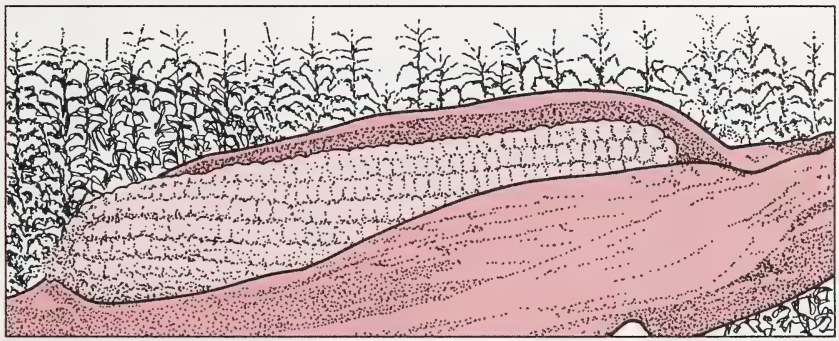
Textbook question 1. (b):

Textbook question 1. (c):

Textbook question 1. (d):

Textbook question 1. (e):

Textbook question 1. (f):



10. Corn needs plenty of sunshine in order to grow well. Suppose you wanted to buy farmland in Alberta in order to start a corn farm. Where would you obtain the land – near Taber or in the Peace River area? Tell why. (You may need to use a map of Alberta to find these places.)

Check your answers by turning to the Appendix, Section 1: Activity 2.

Abiotic factors can change over short distances as in a backyard. You can also see general patterns of abiotic factors over large areas such as the prairie provinces. The abiotic factors influence what grows where.

Activity 3: Quadrat Sampling

In the previous activity you measured abiotic factors. In describing the biotic parts of the environment, you will need to know the numbers of living things.

Read Measuring Populations on page 303 of *Science Directions 8*. In the reading, the word habitat is used to refer to a region in which a plant or animal lives. A secondary consumer is an animal that eats other animals that in turn live off plants. For example, a hawk that eats ground squirrels is a secondary consumer.

1. Give some reasons for wanting to know the population sizes of organisms.

   _____

   _____

   _____

   _____

2. Ecologists count organisms within small _____ in order to estimate the population size.

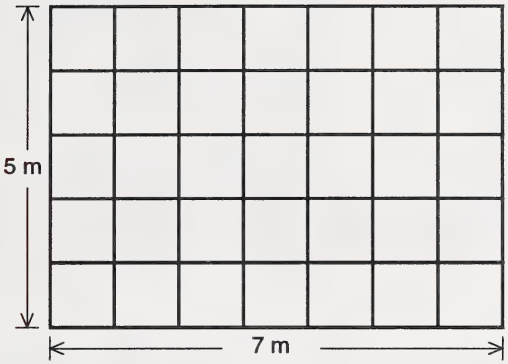
Check your answers by turning to the Appendix, Section 1: Activity 3.

Quadrat sampling: sampling that uses small plots as samples from a large area

You will estimate the number of dandelions in a rectangular area of lawn. To determine the population of dandelions you will use **quadrat sampling**. You will use several 1 m by 1 m square samples, each having an area of one square metre (1 m^2). You will count the number of dandelions in each of the samples and then take the average. In estimating the number of dandelions in the whole lawn, you will multiply this average by the area (in square metres) of the lawn.

Maybe you need to review the idea of area. To find the area of the lawn, you multiply the lawn's length by its width. For example, a lawn having a width of 5 m and a length of 7 m has an area of 35 m^2.

The area can be covered by 35 little squares, each measuring 1 m by 1 m. That is why you say the area is 35 m^2.



8 Science Directions

Refer to Activity 6-7 on pages 304 and 305 of your textbook. Follow the procedure. If you are working on your own, rather than in a class, use the average number of dandelions from four quadrats that you construct.

3. Use the following space to record the numbers of dandelions in the quadrats.

4. Calculate the average number of dandelions in the quadrats.

5. What is your estimate of the dandelion population in the lawn?

6. Do the following from Finding Out on page 305 of your textbook.

   Textbook question 1:

   _____

   _____

   Textbook question 2:

   _____

   _____

Check your answers with your learning facilitator.

Activity 4: Other Methods of Estimating Populations

Sometimes you may find that you do not need to estimate the population of a particular plant. Rather, you just want to know how the populations of several different plants compare to each other. Then you can use a stretched string to determine the sample area.

Read page 305 of your textbook to learn about another way of measuring populations.

1. What sampling method can be used in areas having trees and bushes?

   _____

Refer to Activity 6-8 on page 306 of your textbook. When you read Table 6-2, note that the left column is really a list of intervals on the line, not points.

2. Do the following questions from Finding Out on page 306 of your textbook.

   Textbook question 1:

   _____

   _____

Textbook question 3:

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 4.

So far you estimated populations of plants. What would you do to get a count of birds or grasshoppers? These creatures do not stay put inside a quadrat or under a string. They move around. What can you do to estimate populations of living things that move?

Read Estimating Animal Populations on pages 307 and 308 of your textbook.

3. Large animals that gather in groups can be _____ in order to count them. Another method, used to estimate populations of small animals, is the _____ method.

4. Suppose that you counted grasshoppers in a field. One morning you collected seventy-five grasshoppers. You marked them and then released them. In the afternoon you collected sixty grasshoppers. You found that twelve of the grasshoppers were marked. Assume that the grasshoppers were confined to the field. What do you estimate the grasshopper population size to be? Show your calculations.

Check your answers by turning to the Appendix, Section 1: Activity 4.

You are to do Activity 6-9 on page 308 of your textbook. Instead of beans you can use elbow macaroni. You should have the lid for the jar you will use.

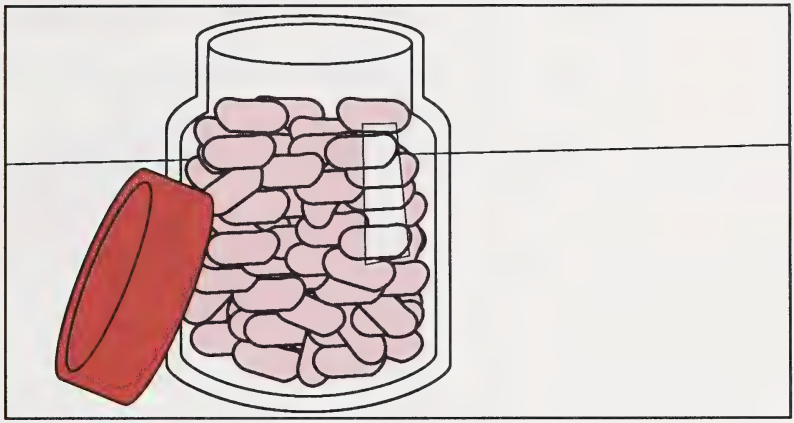
5. What is given as the problem?

Follow the procedure of Activity 6-9 on page 308 of your textbook.

6. Record your estimate based on your observations.

7. Tell what you will do to estimate the bean population using the mark-recapture method.

8. What is your estimate of the bean population using the mark-recapture method? Show your work.



9. How many beans were actually in the jar?

_____

10. How accurate was the mark-recapture method?

_____

_____

11. How could you increase the accuracy of your estimate?

_____

_____

_____

12. Do question 3 of Finding Out of Activity 6-9 on page 308 of your textbook.

_____

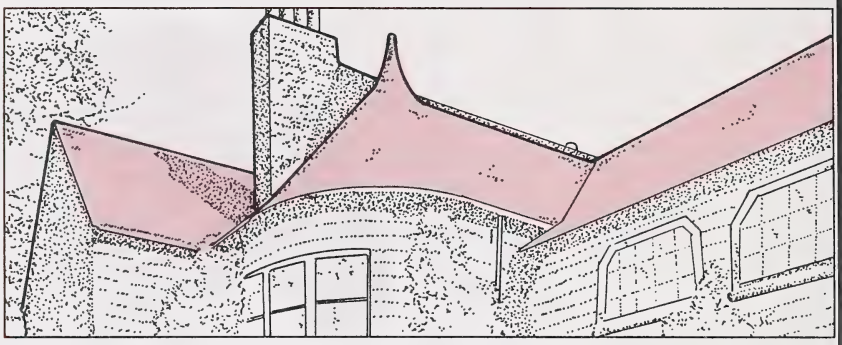
_____

_____

_____

Check your answers with your learning facilitator.

Activity 5: Where Organisms Live



Think for a moment about where you live. What does your place look like? What is it about your place that makes it home?

1. Write a few sentences you would use to describe your home to a friend.

_____

_____

_____

_____

Share your answers with your learning facilitator.

Your home is a comfortable place for you to live. All organisms must live in an environment they can be comfortable in.

Where you live can be thought of as a house or apartment. You can also think of your town, country, continent, and planet as where you live. It depends on how specific you want to be. There are also different levels that you can use to refer to a location in the environment.

8
Science Directions

Read pages 280 and 281 of your textbook.

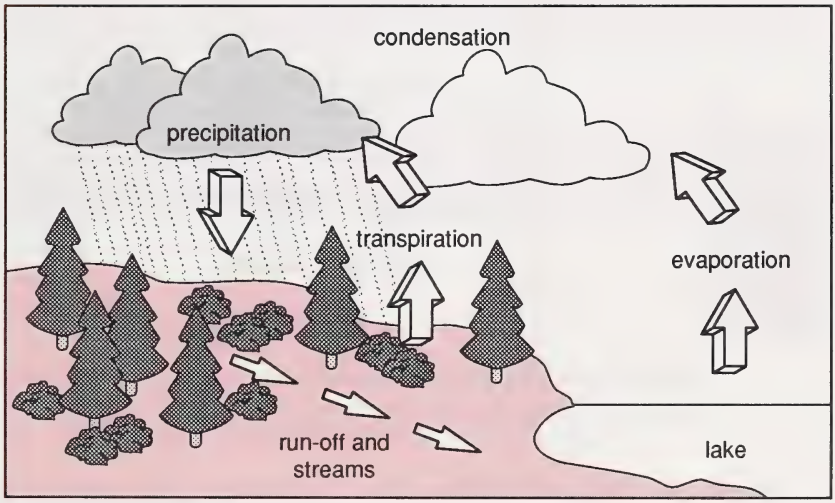
2. The largest ecosystem on Earth is the _____.

3. Give one example of how one part of the biosphere can affect another part far away.

_____

_____

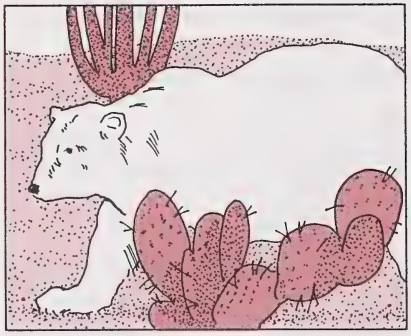
The biosphere is almost a closed system. All it needs to keep going is energy from the sun. Matter that is used by organisms is recycled. One cycle that you are familiar with is the water cycle.



The water cycle

Nitrogen is also recycled. Air is 79 percent nitrogen gas. In this form, it is not usable by plants. Lightning and nitrogen-fixing bacteria in the soil change the nitrogen gas to nitrates, which plants can use. When plants and animals which eat plants die and decompose, the nitrogen gas is again released.

There are other cycles as well. All these cycles are nature's way of recycling. Because of this recycling, the biosphere is almost self-sustaining. No materials have to be added; just energy from the sun is required.



4. Tell why the two pictures appear to be incorrect.

_____

_____

You associate certain large areas with certain kinds of living things. Large areas within the biosphere which have distinctive environments are called **biomes**.

Biome: a large area within the biosphere which has distinctive climate, soils, plants, and animals

Read Biomes on pages 282 and 283 of your textbook.

5. List the forest biomes.

_____

_____

_____

6. Why do the biomes change as you move away from the equator?

_____

_____

7. Name two biomes of Alberta.

_____

_____

8
Science Directions

In biomes there are smaller areas in which organisms live. To find out about these, read Habitats and Micro-environments on page 284 of *Science Directions 8.*

A micro-environment is also called a microhabitat. The words are synonymous.

8. How does a micro-environment differ from a habitat?

_____

_____

_____

_____

Check your answers by turning to the Appendix, Section 1: Activity 5.

Look ahead to Section 3, Activity 3. As soon as you can, start growing the mould in the manner described.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

Some of the abiotic parts of the environment can be described by measuring light brightness, soil moisture, temperature, and wind speed. Populations, which are the biotic part of the environment, can be determined by quadrat sampling, the line-transect method, photography, and the mark-recapture method.

From the study of the environment, you can see that abiotic conditions affect the biotic part of the environment. The biosphere contains different biomes. The general characteristics of each biome is largely affected by climate and soil. Within biomes there are habitats – smaller regions in which organisms live. Still smaller regions are micro-environments (microhabitats) that have abiotic conditions different from the surrounding environment. Particular organisms that have a narrow range of tolerance live in these micro-environments.

1. Name four abiotic factors.

_____

_____

2. What method would you use to determine the size of a herd of caribou?

_____

3. When would you use the mark-recapture method to determine a population size?

_____

_____

4. Match the expressions in the left column with the words in the right column.

_____ a. a pond	A. biome
_____ b. bottom of a pond	B. biosphere
_____ c. the largest ecosystem	C. habitat
_____ d. northern coniferous forest	D. micro-environment

Check your answers by turning to the Appendix, Section 1: Extra Help.

Enrichment

Do either Part A or Part B.

Part A requires the use of a dice. Part B involves some research.

Part A

Refer to the photograph on page 307 of your textbook. The caption tells you how to count the birds in the photo. Suppose you wanted to take a short cut by using a sampling procedure which involved counting only four squares.

1. How could you use two throws of the dice to pick a square randomly?

_____

_____

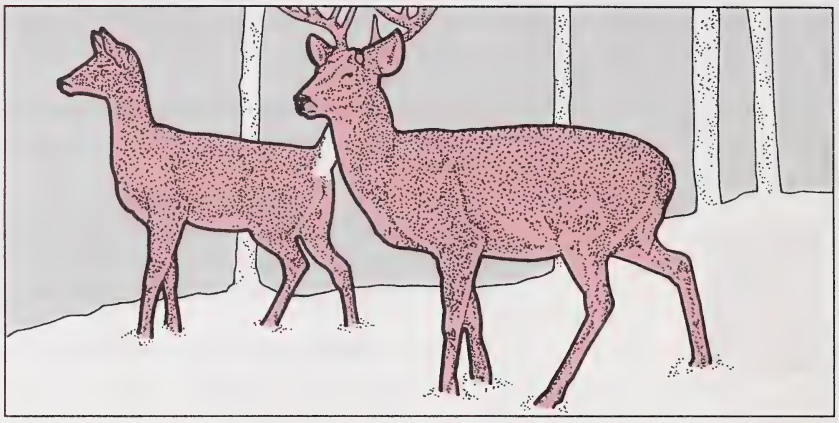
Pick four squares randomly using your dice. Count the birds in each square.

2. Tabulate your results.

3. Based on the number of birds in the four sample squares, what is your estimate of the total number of birds in the photograph?

Check your answers by turning to the Appendix, Section 1: Enrichment.

Part B



Research the following: How is the deer population estimated in order to set hunting limits? You may use the library or some other source of information. For example, you may contact (by phone) the Fish and Wildlife Division of Alberta Energy and Natural Resources. When talking to resource people be sure to introduce yourself and tell why you are doing the research.

4. Report on your research; tell what you found out and where and how you obtained the information.

Share your answers with your learning facilitator.

Conclusion

Biotic and abiotic parts make up the environment. Light brightness, soil moisture, temperature, and wind speed are some abiotic factors. The presence of populations, which are part of the biotic environment, can be estimated by various sampling methods.

Abiotic factors influence the biotic component of the environment. Within the biosphere are biomes, which are large areas with their own characteristic plants and animals due to particular climate and soil conditions. Within the biomes are different habitats and micro-environments with distinctive conditions that support a variety of organisms.

Assignment Booklet

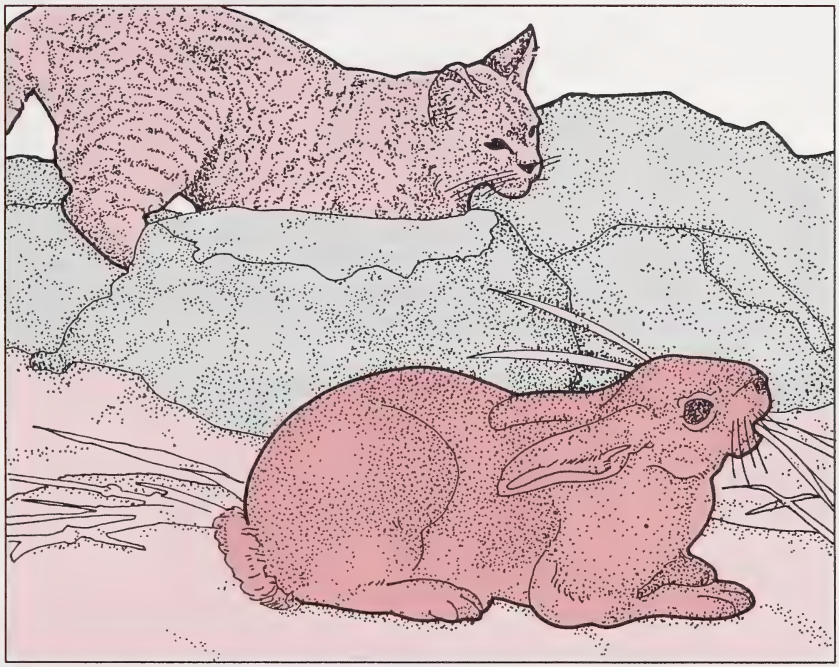
ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 1.

Section

2

Interdependencies



A bobcat depends on rabbits and other living things for food. This dependency is a predator-prey relationship between one organism and several others. Every organism depends on its environment and other organisms in a variety of ways.

You will learn how nutrients and energy travel through different organisms connected by a food relationship. In a food relationship, one organism is eaten by another; you will find out about other relationships between organisms in which both partners remain alive. You will also recognize that organisms have certain functions to perform and that they have certain specializations to allow them to carry out their way of life.

Activity 1: Energy and Nutrients

On a typical day you might walk to school, help with chores around the house, and go for a bike ride. Where does your energy come from? You know it comes from the food you eat. For example, you may have had an eggs, bacon, fruit, and juice for breakfast.

8 Science Directions

1. Refer to the photographs on page 288 of *Science Directions 8*. How do the three organisms obtain their food?

_____

_____

_____

Check your answers by turning to the Appendix, Section 2: Activity 1.

8 Science Directions

Read page 288 and the top half of page 289 of your textbook.

2. Match the following by placing the capital letters in the appropriate blanks.

_____ a. moose	A. producer
_____ b. wolf	B. primary consumer
_____ c. water lily	C. secondary consumer

3. An animal that feeds on secondary consumers is called a _____ consumer.

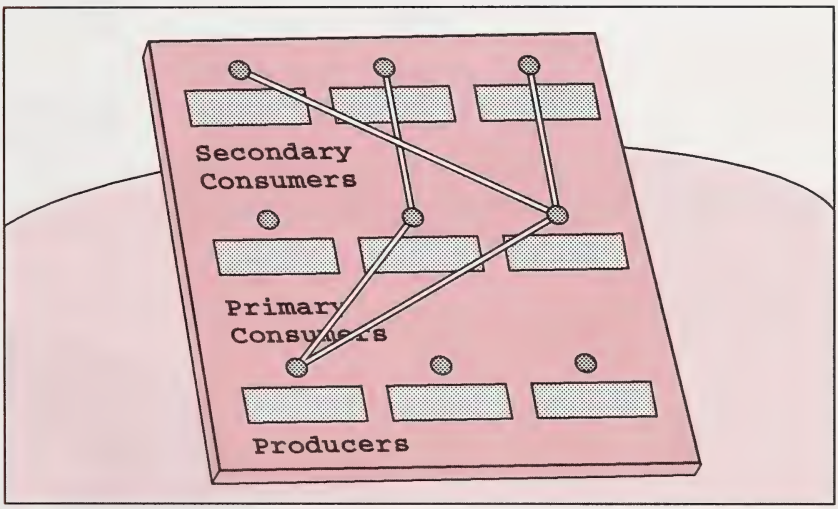
Read Food Chains and the Flow of Energy on pages 289 to 291 of your textbook.

The following is a food chain that has four organisms:

grass → mouse → snake → hawk

4. Find a food chain having six organisms within the food web on page 291 of your textbook. Show this food chain in the space.

Refer to Activity 6-4 on page 292 of your textbook. You will make a chart with producers, primary consumers, and secondary consumers along rows as shown in the diagram.



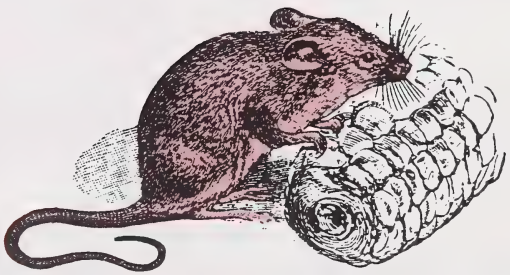
You'll connect the entries with coloured strings to show energy flows. You'll connect a producer to a primary consumer that feeds on it. Then you'll extend the string to a secondary consumer that feeds on the intermediate primary consumer. You will continue by making all the various possible connections involving the same producer in one unique colour.

You will repeat this process with the other two producers – each time using a different colour.

You'll need a piece of cardboard measuring about 30 cm by 30 cm. Instead of adhesive labels you can use pieces of paper and glue.

If you can, use reference materials about Alberta plants and animals to help you find out who eats whom. If you can't, you'll find the following table provides enough information.

Consumer	Food Source
badger	• eats mice, ground squirrels, and vole
coyote	• hunts small rodents and rabbits • scavenges almost anything
ground squirrel	• eats green vegetation
grouse	• eats leaves, buds, even twigs
hawk	• eats rabbits, squirrels, mice, and sometimes birds such as grouse
mouse	• eats seeds and nuts



Collect the materials you need and do steps 1 to 9 of the procedure of Activity 6-4 which is on page 292 of your textbook.

8 Science Directions

5. Do step 10 of the Procedure on page 292 of your textbook. Copy the food web in the following space.

8 Science Directions

6. Do the following from Finding Out and Finding Out More on page 293 of your textbook.

Textbook question 1:

_____

_____

Textbook question 2. (a):

_____

_____

_____

Textbook question 2. (b):

Textbook question 2. (c):

Textbook question 3:

Textbook question 4:

Check your answers with your learning facilitator.

grass → mouse → snake → hawk

In this food chain, energy moves along from left to right. The grass collects energy from the sunlight so the energy does not run out. However, the grass also needs nutrients to grow and to supply the rest of the food chain. The nutrients follow the energy flow from left to right. The nutrients would run out were it not for another group of organisms that bring the nutrients back to the beginning of the food chain.

Read The Nutrient Cycle on pages 293 and 294 of your textbook.

7. Organisms that feed on dead and waste material are called

   _____.

8. Draw a cycle involving grass, a mouse, a snake, and a hawk to show how nutrients are recycled.

9. What two microorganisms serve as decomposers?

   _____

   _____

10. Refer to your food web from question 5 of this activity. Pick one of the producers and assume that it is watered with a chemical that can be traced. Which consumers will have traces of the chemical in their bodies?

    _____

    _____

    _____

    _____

11. Give three ways other than chemical tracing by which scientists can determine who eats whom.

_____

_____

_____

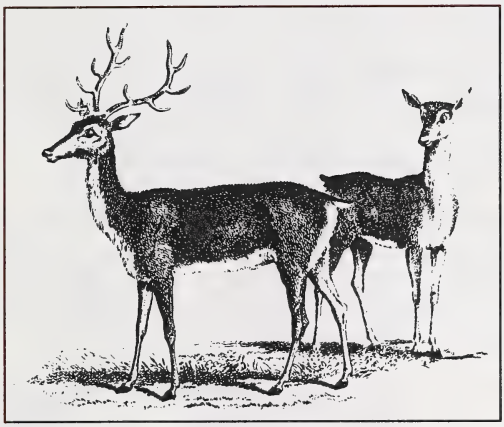
12. Suppose a pack of wolves is seen in the vicinity of a caribou herd over several months. Make an inference: What do the wolves depend on for food?

_____

Food webs transfer the sun's energy in one direction from producers to all the consumers. Decomposers allow the nutrients to be recycled back to the producers.

Check your answers by turning to the Appendix, Section 2: Activity 1.

Activity 2: Populations and Food Chains



You learned that there are many ways to estimate population sizes. Using the estimates, scientists have found a relationship between the size of a population and its level in a food chain. Predict the relative numbers of deer and wolves in a community. Would there be more wolves than deer or the other way around?

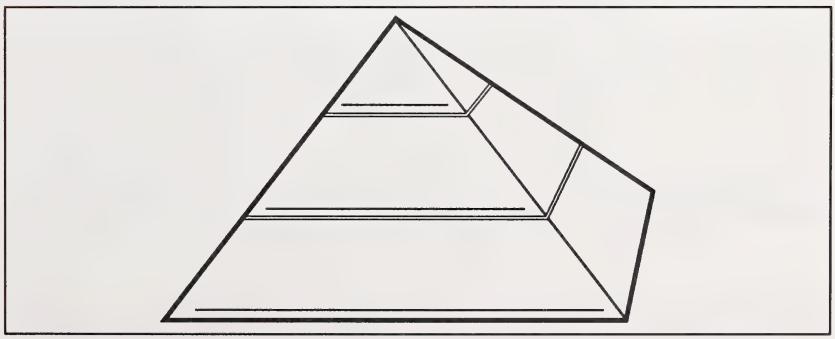
Read page 309 of your textbook to find out.

1. What does a pyramid of numbers show?

_____

_____

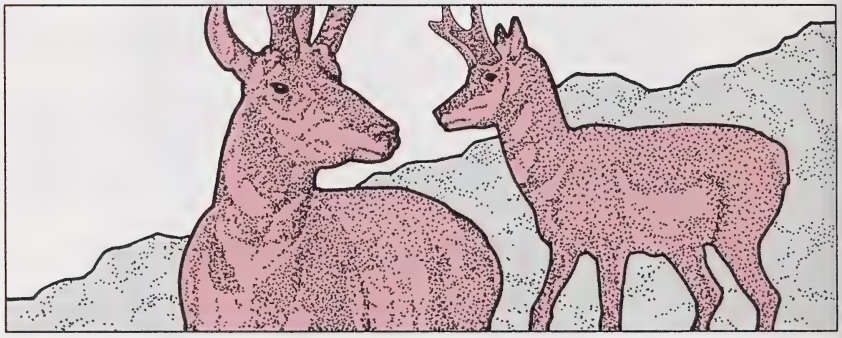
2. Place mouse, coyote, and grass in the correct position on the side of the pyramid to show how population sizes compare in a community.



To describe the feeding of thousands of insects on a tree you would get an upside-down pyramid. So you can see from this atypical example, that looking at numbers of organisms does not give a complete picture. But suppose you took a weighing of the one tree and the thousands of insects feeding on the tree. The mass of the tree would be far greater than the mass of all the insects. Therefore, using the masses, you would still get a normal pyramid.

Read Biomass on page 310 of your textbook.

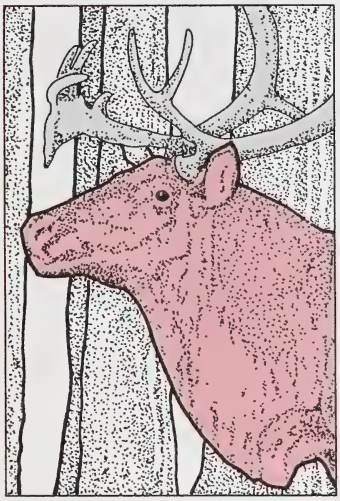
Comparing biomasses rather than numbers of organisms gives a better picture of energy flow. Although the loss of biomass varies greatly, on the average only 10 percent of the biomass at one level is converted to biomass at the next level of the food chain. The loss in biomass means that organisms further along a food chain have less energy available to them.



3. The average mass of a pronghorn is 50 kg. What is the biomass of ninety-five pronghorn antelope? Show your calculations.

4. Calculate the number of wolves for the following food chain:

moss → caribou → wolf



Assume that just 5 percent of the biomass is conserved in going from the primary consumer to the secondary consumer. The caribou population is 800. The average mass of a caribou is 100 kg and the average mass of a wolf is 50 kg.

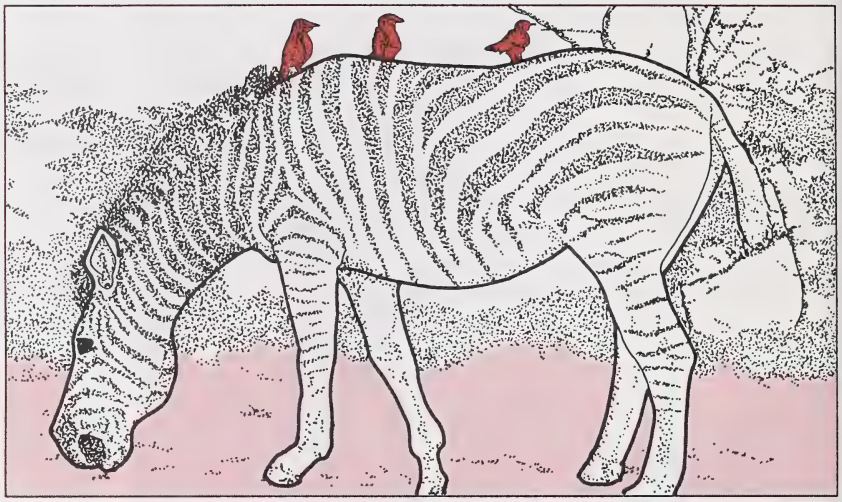
The loss of biomass at each level of the food chain is represented by a pyramid of biomass. Generally, there is also a reduction in population as you go up a food chain. This is shown by a pyramid of numbers.

Even though the food chain may not be a very efficient pipeline, it represents a strong linkage between organisms. Consumers depend on all the other organisms before them in the food chain for life-sustaining energy and nutrients.

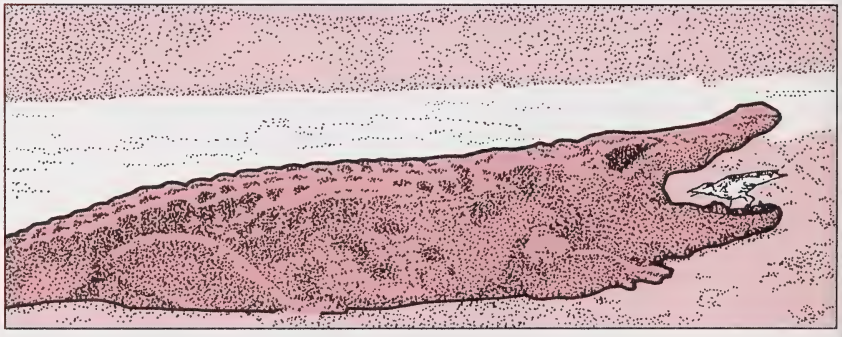
Check your answers by turning to the Appendix, Section 3: Activity 2.

Activity 3: Other Interactions Among Organisms

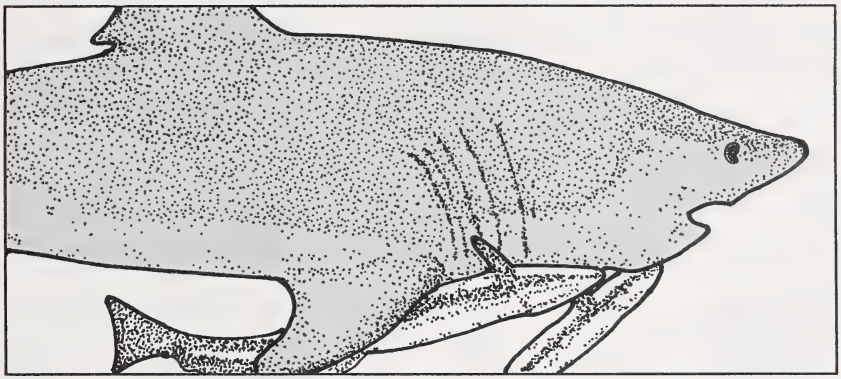
What are the birds doing on the zebra's back?



The birds in the illustration live close together with the zebra. The birds help the zebra by removing irritating insect pests living on the zebra's skin. The birds are provided with a food source by the zebra.



In Egypt, a plover can be seen picking away at leeches on the gums along the teeth of a crocodile. The crocodile leaves its mouth open to let the bird in and out of its mouth. The bird gets an easy meal and the crocodile keeps healthy gums.



The fish attached to the shark are remora fish. They are also called shark suckers since they have suckers by which they attach themselves. The remora fish attach themselves temporarily to the shark to get a ride to the shark's next feeding site. The remora fish feed on scraps left by the shark. Interestingly, the shark does not even try to prey on them. The remora fish do no harm to the shark nor do they provide a benefit to the shark.

Brightly coloured shrimp crawl over certain fish. These fish actually seek out the shrimp and then stay still to allow the shrimp access to them. The shrimp pick off pests on the fish's surface and the shrimp clean surface injuries. You can see that both the fish and shrimp benefit from this interaction.

WESTFILE INC.

Pine trees, and other kinds of trees, have a special relationship with a fungus in the soil. The fungus covers the roots and enables the roots to absorb water and nutrients more easily. The fungus thrives under the trees because there it is nourished by organic material released by the tree.

Many types of wasps deposit their eggs into the bodies of other insects. When the eggs hatch, the larvae feed on the body tissue of the still living insects. In Southern Mexico, there is actually a ten-centimetre long wasp that lays its eggs in the body of a tarantula.

The interactions between birds and zebras, plovers and crocodiles, remora fish and sharks, shrimp and fish, trees and fungi, and wasps and other insects are different from those between organisms of a food chain.

Read pages 295 and 296 and the top half of page 297 in your textbook to find out more about these different interactions.

1. Match the following symbiotic relationships with their correct definition.

_____ a.	a relationship in which one species is harmed and the other benefits	A. commensalism
		B. mutualism
_____ b.	a relationship in which both species benefit	C. parasitism
_____ c.	a relationship in which one species benefits and the other neither benefits nor is harmed	

2. Commensalism, mutualism, and parasitism are all special kinds of the relationship called _____.

3. This question refers to the interactions described earlier. Classify the relationships as commensalism, mutualism, or parasitism. Indicate which relationship benefits, which is harmed, and which is not affected either way.

   a. the birds and zebras

   _____

   _____

   _____

   b. the plovers and crocodiles

   _____

   _____

   _____

c. the remora fish and sharks

d. the shrimp and fish

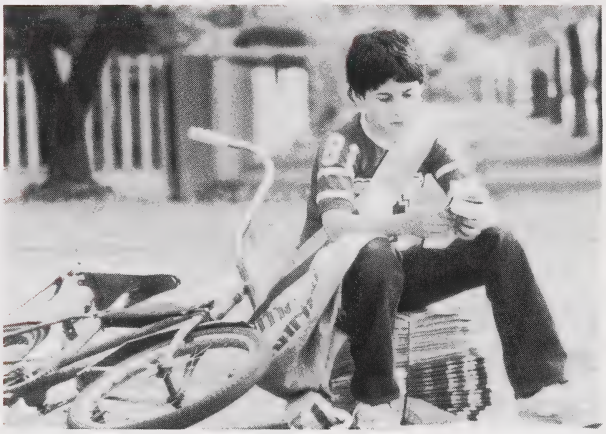
e. the pine and fungi

f. the wasps and other insects

4. Give an example of your own for each of the three kinds of symbiosis. Give reasons for your classification.

Check your answers with your learning facilitator.

Activity 4: Niches, Habitats, and Specializations



WESTFILE INC.

This boy has a job to do. Many people in his community are affected by how newspaper carriers do their job.

In nature, the activities of one species affect the lives of many other species. Earthworms boring holes in the soil aerate and loosen the soil. This helps grass to grow. Wolves eat deer weakened by disease. This helps the rest of the herd stay healthy. Trees host mistletoe and provide shelter for wildlife. The kinds of jobs that species do are numerous.

Read Niches on pages 297 and 298 of your textbook.

It may be easy to mix up the meaning of habitat and niche. After all, in everyday use, a niche can refer to a recess or hollow in a wall. However, when you use the word niche in dealing with organisms in the environment, niche does not refer to a place but the job of an organism.

1. Use the words habitat and niche correctly in the following sentence.

   An organism's _____ is its way of life which allows it to live in a _____ along with the rest of the community.

Notice from the textbook reading that being a producer, primary consumer, secondary consumer, tertiary consumer, host, and parasite are some general niches.

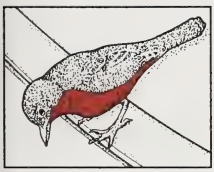
One way to recognize the niche of an organism is to determine

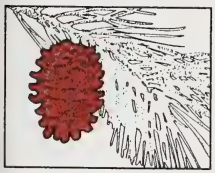
- how the organism uses biotic and abiotic parts of the environment
- how the organism is used by other organisms

Read the paragraph Endangered Species on page 298 of your textbook for an example showing how niches are interwoven.

2. Describe the niche of the ground squirrel, robin, and pine tree by completing the table.

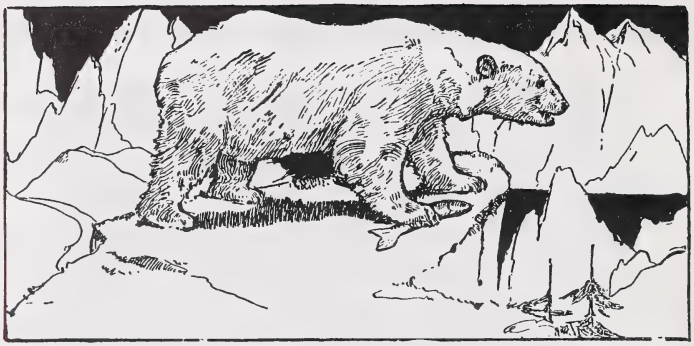
Organism	How Organism Uses Parts of the Environment	How Organism Is Used by Other Organisms
ground squirrel		
robin		
pine tree		



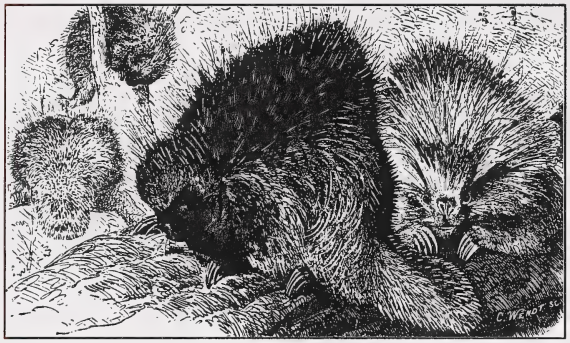


An organism must live somewhere (its habitat) and must perform some role (its niche). In order to survive, an organism must be adapted for both its habitat and its niche. The organism may have a **specialization**.

Specialization: an adaptation of a body part for a particular habitat or niche

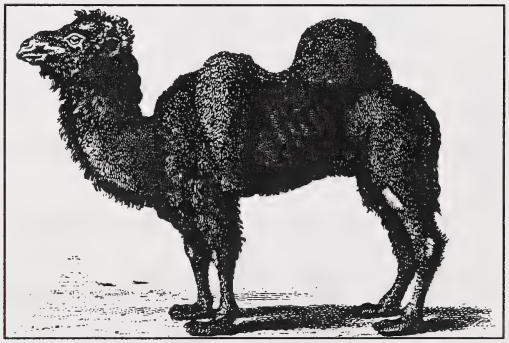


A polar bear must have a thick layer of fur and a layer of fat under its skin to protect it from the cold.



Quills on a porcupine allow it to live in a habitat containing coyotes, wolves, and other creatures that would otherwise threaten it.

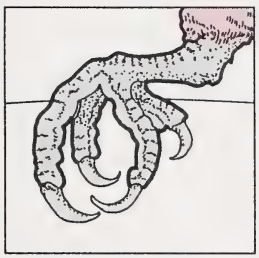
3. Look at the camel. Identify one specialization that helps it live in the desert.



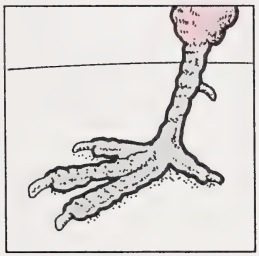
4. The feet of birds show specialization for different habitats. Infer what the bird feet are adapted for. Match the feet with the descriptions by placing the capital letters in the blanks.

   A. for swimming on water
   B. for perching in trees
   C. for walking on grassland

_____ a.



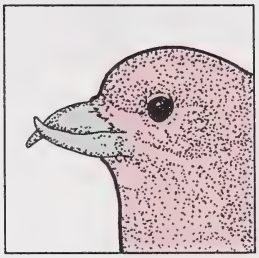
_____ b.



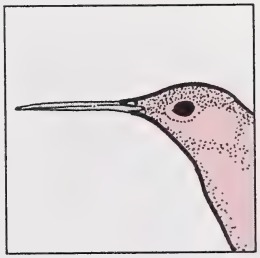
_____ c.

5. The beaks of birds show specializations related to different consumer niches. Infer for what foods the beaks are adapted. Match the beaks with the foods by placing the capital letters in the blanks.

_____ a.

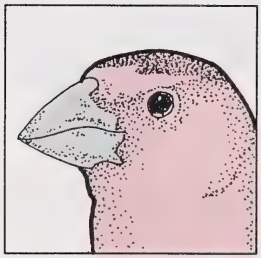


_____ b.



_____ c.

_____ d.



A. nectar from flowers

B. pine cone seeds still inside the cones

C. seeds within hard outer coverings

D. mice and other small animals

You now see that organisms are especially suited to particular habitats, as well as to niches. But what happens when there is a change in the environmental conditions? Or what happens when there is a change to the characteristics of an organism? You will think about the effects of change in the following questions.

6. Predict the effects on the organisms in the following situations.

   a. a hawk injures its feet

   b. a mallard duck gets its bill stuck in a plastic six-pack can holder

   c. a wolf gets its jaw broken in an encounter with a bear

   d. a porcupine, due to some abnormality, does not grow quills

7. A rabbit, which normally changes colour from brown to white in the fall, is still brown when the ground is covered by an unusually early snowstorm. What is the effect on the rabbit?

8. A fish population moves to deeper water for food. How will birds that feed on the fish be affected?

9. The level of a lake rises due to a heavy spring run-off and the sandy beach is covered by 1 m of water. Give your prediction for the birds and plants.

_____

_____

An organism is adapted for its habitat and its niche. When the habitat or environment changes, the organism may not be able to cope with the change. When there is a change in the characteristics of an organism, the organism may no longer be able to carry out its niche or live in its habitat.

Check your answers with your learning facilitator.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

There are many interdependencies among the biotic and abiotic parts of the environment. Organisms can be connected by a food chain. Food chains begin with producers, which are followed by primary and secondary consumers.

As you go up the food chain, populations generally go down and biomass always goes down. This trend is shown by pyramids of numbers and biomass.

In order to describe a community many food chains are needed. These chains together make up a food web. Decomposers return nutrients to the producers.

There are also symbiotic relationships between organisms. There are three types of such relationships: commensalism, mutualism, and parasitism. In all such relationships, at least one organism benefits and its partner may or may not be harmed.

All organisms have a habitat and a niche. When you know an organism's habitat and niche, you know the organism's relationship with the abiotic and biotic parts of the environment. A change in the organism itself or in its environment can have a serious effect on its chances for survival.

1. Carbon, nitrogen, phosphorus, and calcium are _____ which are needed for the growth and repair of a plant or animal. These substances are returned to the environment by way of special organisms called _____.

2. Besides nutrients organisms need _____, either directly from the sun or from their diet, for growth and activities.

3. Make a food chain involving a frog, a grasshopper, grass, and a hawk. Identify each organism as a producer, primary consumer, secondary consumer, or tertiary consumer.

4. A combination of interconnecting food chains is a _____.

5. The three types of symbioses are _____, _____, and _____.

6. Match the following symbiosis with an example from the right hand column.

_____ commensalism	a. a mistletoe growing on a tree
_____ mutualism	b. cattle egrets following cattle for the insects that the cattle stir up
_____ parasitism	c. a lichen

7. What is the biomass of a flock of 150 ducks? The average mass of a duck in the flock is 900 g.

8. grass → gopher → badger

In this food chain the badger population is only 10 percent of the gopher population biomass. If the gopher population biomass is 7500 kg, what is the badger population biomass?

9. Suppose a skunk lost its scent gland. Predict the effect on the skunk's ability to survive. Give reasons for your conclusion.

10. Moose live in forests. They eat a variety of vegetation; but for the most part they eat new growth from trees and bushes. Predict the effect on the moose population when large areas of forest are cleared.

Remember, there is a complex interrelationship between the biotic and abiotic parts of the environment. A change in one part affects many other parts.

Check your answers by turning to the Appendix, Section 2: Extra Help.

Enrichment

Make a food web involving at least ten different types of living things found in the parkland of the prairie provinces. You may have to do some research to find out more about the niches of certain plants and animals. In particular, you'll want to know the feeding habits of the animals.

Following is a list of some living things found in the parkland. You may include all or some of the plants and animals listed. You may also include plants and animals of the parkland that you know of but that are not listed.

Tiger swallowtail butterfly

Black-capped chickadees

Tent caterpillar

Coyote

White-tailed deer

Bracket fungus

Snowshoe hare

Red-tailed hawk

Black-billed magpie

Mosquito

Poplar sphinx moth

Deer mouse

Saw-whet owl

Prickly rose

Mashed shrew

Clay-coloured sparrow

Franklin's ground squirrel

Richardson's ground squirrel

Red-eyed vireos

Meadow vole

Yellow warbler

Short-tailed weasel

Place the good copy of your food web in the space provided.

Share your answers with your learning facilitator.

Conclusion

Interdependence in a community is so common! Food chains show how organisms depend on each other. Symbiosis is another linkage between organisms. Every living thing has a niche. The niche of every organism contributes to the overall survival of the community. Organisms are suited for their niche and their habitat through specializations. An organism's ability to survive can be affected by a change in the organism itself or by a change in its environment.

Assignment Booklet

ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 2.

Section

3

The Environment and Human Activities

WESTFILE INC.

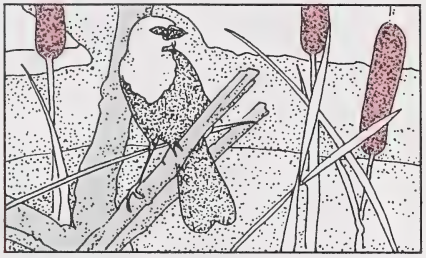
Humankind depends on the environment for many of its needs. One of those needs is a supply of food. People farm land for crops. Forests may have to be cleared or grass plowed under to make way for the crops. When forests are cleared a habitat disappears. When pesticides and herbicides are used to protect the crops, other living things in the environment may be affected.

There are many other human activities that also affect the environment. Building towns and cities, operating factories, and hunting, to name just a few, all have impacts.

You will learn that human activities can have consequences other than those that were intended. You will find out about certain kinds of pollutants and their effects. You will also learn that adding or removing living things to or from a region may have unexpected results.

Activity 1: A Habitat on the Prairies

All across the prairies you can find shallow ponds called sloughs. Maybe you think of them as being big dirty puddles of water surrounded by a few bulrushes and having a few ducks on it. Well, there is more there than what meets the eye. By studying the interactions of the living things of a slough, you will see that it is home to many organisms.



8 Science Directions

Read An Ecosystem in Action on page 311 of your textbook.

The slough demonstrates in miniature what is true for the whole biosphere – every living thing is part of the much larger web of life connecting all organisms.

8 Science Directions

Refer to Activity 6-10 on pages 312 to 314 of your textbook.

1. What is the question you will be answering?

_____

_____

Instead of relying on firsthand experience, read the information and examine the illustration provided. Also note that dragonfly larvae feed on water mites and mosquito larvae, dragonflies eat water striders, and frogs eat water striders and dragonfly larvae.

8 Science Directions

2. Do questions 1 to 6 from Finding Out on page 314 of your textbook.

   Textbook question 1:

_____

_____

_____

_____

Textbook question 2:

Textbook question 3:

Textbook question 4:

Textbook question 5:

Textbook question 6:

3. Do questions 7 and 8 from Finding Out More on page 314 of your textbook.

Textbook question 7:

Textbook question 8. (a):

Textbook question 8. (b):

Check your answers with your learning facilitator.

When a slough disappears, a whole community of living things is affected.

Activity 2: Pesticides and the Food Chain

Have you ever sat outside on a warm summer's evening only to find that mosquitoes were spoiling what otherwise would be so pleasant? Wouldn't it be nice to zap them with a spray of **pesticide**? Actually using pesticides on a large scale can solve a problem, but it may in turn create other problems.

Pesticide: a substance used to kill any organisms that are considered by human beings to be harmful

Read pages 315 and 316 in your textbook in order to see

- why humans alter the environment
- why people are capable of making such a large impact
- how pesticides can be serious **pollutants**

Pollutant: a substance that is released into the environment and is harmful to living things

1. Name four human occupations that provide foods or materials.

   _____

   _____

2. The development of _____ allows people to change the environment on a much larger scale than before.

Do Activity 6-11 on pages 316 and 317 in your textbook.

3. What is the question you will find the answer to?

   _____

   _____

   _____

Follow the Procedure.

4. Do questions 1 to 5 of Finding Out on page 317 of your textbook.

   Textbook question 1:

Textbook question 2:

Textbook question 3:

Textbook question 4:

Textbook question 5:

5. Do question 6 of Finding Out More on page 317 of your textbook.

Textbook question 6. (a):

Textbook question 6. (b):

Read Did You Know? on page 317 of your textbook.

6. What evidence is there that even remote parts of the biosphere are affected by pollutants?

Check your answers with your learning facilitator.

Pesticides such as DDT are not the only substances to be built up or magnified as they go up the food chain. Lead and mercury, for example, are also poisons that follow the food chain. Fortunately, lead has been removed from gasoline; so lead will be less of a threat. Also, industry has reduced the amount of mercury pollution. For example, alkaline batteries contain small amounts of mercury and even this small amount has been reduced by the battery manufacturers in the last few years.

Read Biological Indicators on page 318 of your textbook.

Levels of chemical pollutants are now monitored by various means so that if dangerous levels are reached, corrective action can be taken.

Activity 3: The Effectiveness of Chemical Controls

In the previous activity you discovered that a pesticide can reduce the population of a natural predator. This reduction of the natural predator population can actually result in the increase of the pest population.

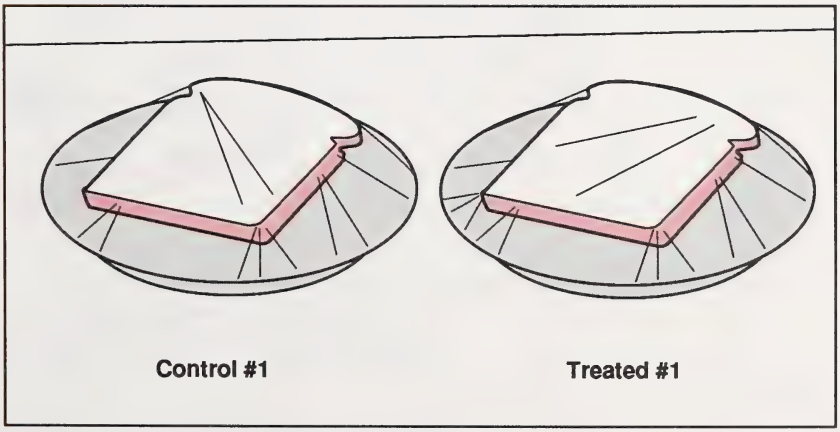
A pesticide can also change the characteristics of a pest population it's aimed at. When this happens the pesticide may lose some of its effect. This phenomenon can be shown to you by growing mould. You'll see mould that survives one spraying will be able to better withstand a second exposure to the spray.

Note that you may continue with other parts of this module as you complete this activity.

You will investigate the question: Are chemicals the best way to control pests?

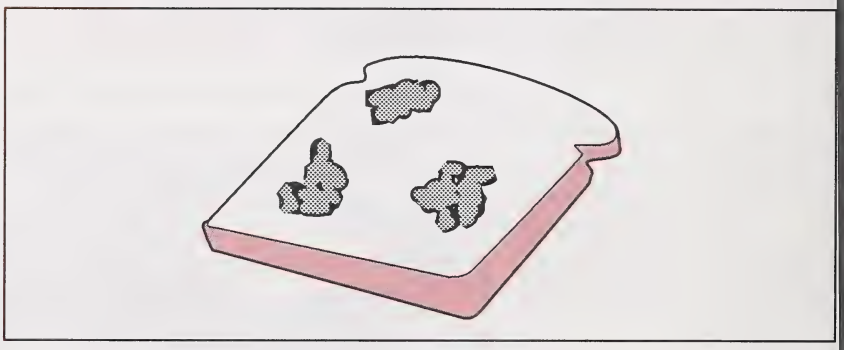
You will need the following:

- container of household spray disinfectant
- four shallow plates or soup bowls
- four sandwich bags or plastic kitchen wrap
- paper towels
- four slices of bread
- dust cloth
- toothpicks



You are to do the following:

- Take two of the plates, and cut two pieces of paper towel to fit the plates.
- Dampen the entire paper towel with water so it is moist. Place a piece of bread on both plates. Wipe a dusty counter or ledge using your dust cloth, and then shake it over both pieces of bread.
- Using your disinfectant, lightly spray one piece of bread. Cover both pieces of bread on the plates with the plastic wrap. Make sure the plastic wrap is pulled tightly over the bread. Carefully poke several holes in the top of the plastic wrap.
- Mark either on a piece of tape or on the plastic wrap near the edge of the plate Control #1 for the unsprayed bread and Treated #1 for the disinfected bread.
- Carefully observe the bread for mould and moisture each day. Record your observations of the growth of mould.
- When you have some mould, prepare two more plates. After you have moistened the paper towels, place two more pieces of bread on the plates.
- Identify mould colonies that are similar in colour and size on both plates.



- With unused toothpicks, select from the Treated #1 plate a suitable colony. Pick it up carefully and place it on the new piece of bread, Treated #2.
- Remove a mould colony similar to the previous colony from Control #1. With new toothpicks, repeat the procedure and place the colony on the new piece of bread. Label this Control #2.

- Both plates should be sprayed with disinfectant this time. Stretch plastic wrap over both plates and label and poke holes.
- Throw away the old bread.
- Check the plates daily for growth and sufficient moisture. Record your observations of the mould.

1. When did you first notice mould growing? On which plate was it? Are there any similarities between the moulds or are they totally different on each piece of bread?

2. Why did you puncture holes in the plastic wrap and moisten the paper towels?

3. Why did you transfer similar moulds to the new plates?

4. After seeing your results in the experiment, how do you think a chemical pesticide answers people's needs?

5. Based on your awareness of food chains, do you think that people should manage crops over a long period of time using only chemical poisons?

Check your answers with your learning facilitator.

Activity 4: Other Effects of Human Activities

You have seen how sloughs are jeopardized by some human activities and you have come to know that the use of certain pesticides can release very nasty pollutants. There are other human activities that affect the environment.

The following newspaper article describes the consequences of the addition of a living thing into the local environment.

Flower choking wetlands, group says

Erin Ellis
Journal Staff Writer

Edmonton

Spikes of hardy purple flowers threatening Alberta's wetlands should be added to the province's list of noxious weeds, says a Ducks Unlimited spokesman.

Alberta still has a chance to ward off a large-scale invasion of purple loosestrife which has choked out marshes in Ontario, Manitoba and B.C., said Les Wetter, provincial agrologist for Ducks Unlimited.

"We are kind of unique in that we have a chance at prevention," Wetter said.

Ducks Unlimited will be asking Alberta Agriculture to step up its war on the plant by adding it to the list of weeds which must be controlled in the province, said Wetter.

Purple loosestrife, also known as lythrum, was introduced to North America from Europe as an ornamental garden flower.

The flower rapidly invades wetlands, eventually covering all the standing water. Habitat for ducks, muskrats and beavers disappears as do natural marsh plants such as bulrushes. The only effective way to kill the plant is by pulling up the whole root or dosing it in herbicides.

DUCKS UNLIMITED

Hardy flowers, called purple loosestrife, threaten Alberta's wetlands, according to Ducks Unlimited.

Although Alberta can still stop full-fledged infestation of purple loosestrife, major outbreaks of the plants are already found in St. Albert's Sturgeon River, Wabamun Lake and south of Spruce Grove, Wetter said.

Alberta Agriculture's provincial weed-control specialist, Shafeek Ali, said there is strong evidence against purple loosestrife to put it on the weed hit list. But that decision will be made later this year.

Even if the purple loosestrife is declared a noxious weed – which requires people to report outbreaks – Alberta Agriculture likely won't force people to get rid of certain types of ornamental lythrum, said Ali. Sterile strains of the plant can be purchased in greenhouses, he said.

Ducks Unlimited would prefer to see all types of lythrum banned to avoid accidental cross-pollination between wild and tame species, Wetter said.[1]

[1] *The Edmonton Journal* for the article from *The Edmonton Journal* "Flower choking wetlands, group says" October 25, 1991, p. A7. Reprinted by permission of *The Edmonton Journal.*

1. Who says that a flower threatens Alberta wetlands?

2. Name the plant that threatens wetlands.

3. How was this plant introduced to North America?

4. In what way does purple loosestrife pose a danger to natural plants and animals?

5. What may Alberta Agriculture do to deal with this problem?

6. What would Ducks Unlimited like to see done to overcome the problem of purple loosestrife?

7. What do you think should be done about purple loosestrife?

_____

_____

_____

_____

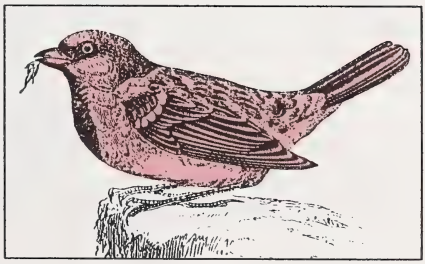
8. What would you do with purple loosestrife if you had some in your garden?

_____

_____

Maybe you've seen signs near lakes warning that the propeller and bottom of each boat must be cleaned in order to prevent the spread of Eurasian water milfoil. Eurasian water milfoil, not native to North America, is quite common in British Columbia. There it has displaced natural wetland vegetation around many bodies of water. Eurasian water milfoil is not a problem in Alberta; maybe thanks to the care taken by boat operators.

The house sparrow was introduced to North America from Europe in the 1800s. It has become a pest because it destroys nests and tosses out eggs and nestlings of many beneficial native birds, such as tree swallows and bluebirds. Affected native bird populations have declined as a result.



In 1859 a farmer in Australia released just twelve pairs of rabbits. Within a few years the rabbits, without predators, had reached a population of tens of thousands. The rabbits soon overran the continent, destroying plant life in many areas. The rabbits outcompeted kangaroos and other primary consumers for grass. They destroyed crops as well. In the 1950s the rabbit population was partly controlled when the rabbits were deliberately infected with the rabbit disease myxomatosis. Nevertheless, the rabbits are now an established pest in Australia.

9. Predict what would happen to the local rabbit population if foxes, wolves, and coyotes were removed from the rabbit habitat?

_____

_____

10. For their diet, sparrows depend to a large degree on spilled grain and garbage left out in the open – an artificial food supply. What do you predict will happen to the swallow and bluebird populations if grain is kept in well-closed granaries and garbage is put in covered containers?

_____

_____

_____

_____

11. Imagine the following: Several farmers in a region have lost some chickens to hawks. In an effort to prevent more chickens from being taken, these farmers band together to kill all the hawks and destroy all their nests in the region. After all the hawks are gone the mouse population increases to such an extent that mice can be seen everywhere scurrying around – especially in the grain fields. The farmers also see a change in the number of grasshoppers.

a. Explain the mouse plague.

_____

_____

_____

_____

_____

b. Predict the change in the grasshopper population. Will it increase or decrease?

_____

Overhunting can have a disastrous effect on a population. The early explorers found thousands of auks on islands off Newfoundland in the 1500s. These birds, which like penguins could not fly, were found to be a good source of food, feathers, and even oil. The birds were excellent swimmers but on land they were slow and ungainly – an easy mark. The birds came to be hunted for their commercial value, and by the 1850s, the auks had completely disappeared.

Read Endangered Species and Did You Know? on pages 298, 299, and 300 of your textbook.

12. Match the following by placing the appropriate capital letter in each blank.

_____ a. auk	A. extinct due to loss of habitat
_____ b. bison	B. extinct due to overhunting
_____ c. extinct	C. extirpated due to overhunting
_____ d. passenger pigeon	D. means no longer existing

13. Most of the extinctions of species occurs today because of

_____.

14. Suppose you were talking to someone who had not developed much interest in plants and animals. What could you say to this person to explain why human beings should be concerned about the extinction of species?

_____

_____

_____

_____

_____

_____

The quality of the air also has an effect on the health of living things.

Read Air Pollution on page 318 of your textbook. Also see the illustration and photographs on page 319 to see what particulates can be collected on exposed microscope slides smeared with petroleum jelly.

Note that not all particles in the air are pollutants. Pollen for example can be naturally occurring and you would not normally consider it harmful to living things.

15. Name two sources of air pollutants.

_____

_____

8 Science Directions

Fly ash is fine particles in the air of ashes and dust due to burning fuels such as coal and oil.

16. List three sources of air pollutants where you live.

_____

_____

_____

When you think about air pollution, water pollution may also come to your mind. Water pollution occurs when fertilizer flows into lakes and streams from crop land, when vegetation is removed from slopes causing an unusual amount of soil to be carried with the run-off into lakes and streams, and when poorly treated sewage is released into bodies of water. Maybe you can think of even more ways by which water pollution occurs.

Human activities have many harmful impacts on the environment. But people are also becoming more conscious of this fact and are concerned about it.

8 Science Directions

Read Finding Answers to Environmental Problems on pages 320 and 321 of your textbook.

17. How does conserving paper help the environment?

_____

_____

With greater public awareness and concern, people can and probably will take action to reduce the harmful impact of human activities.

Check your answers with your learning facilitator.

8 Science Directions

Read Operation Burrowing Owl on pages 322 and 323 of your textbook for an example about how concern for the environment is expressed.

Follow-up Activities

If you had difficulties understanding the concepts in the activities, it is recommended that you do the Extra Help. If you have a clear understanding of the concepts, it is recommended that you do the Enrichment.

Extra Help

You have been introduced to the following concepts:

- Whole ecosystems, (sloughs for example) have disappeared due to human activities.
- Pesticides can build up to high levels in secondary and tertiary consumers.
- Populations may become resistant to pesticides.
- When people bring organisms to a new environment, the foreign organisms can cause problems for the naturally occurring plants and animals.
- When people remove living things from a region, other populations are affected.
- Some human activities have caused the extinction of species.
- Pollution is the result of some human activities.
- People are doing more to help the environment.

1. Make a food chain with the following:

    - alga
    - dragonfly larva
    - frog
    - snake
    - water mite

2. Pesticides _____ as you go up the food chain.

3. Which experiment did you do to demonstrate the development of resistance in a population?

_____

4. Name some organisms that people brought to a new place which later on caused problems.

_____

_____

5. Suppose that this food chain is found in a lake.

alga → fairy shrimp → minnow → perch → pike

The perch is extensively fished so that the perch population decreases.

a. What happens to the pike population?

_____

b. What happens to the minnow population?

_____

6. Name an organism which became extinct due to overhunting.

_____

7. What is the most common reason for the extinction of species?

_____

_____

8. You know that many human activities have resulted in a decrease in the quality of the environment. Why can you still be optimistic about the future of the environment?

Check your answers by turning to the Appendix, Section 3: Extra Help.

Enrichment

You have come to know that plant and animal species have become extirpated and even extinct as a result of human activities. You will write an article about a species that has been severely affected by human activities. Some choices are the peregrine falcon, black-footed ferret, or ivory-billed woodpecker.

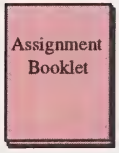
Do Activity 6-6 on page 300 of *Science Directions 8*.

Place the good copy of your article on the lines provided.

Share your answers with your learning facilitator.

Conclusion

People depend on the environment for their needs. In fulfilling those needs, people have an effect on the environment; habitats are changed, pesticides are spread, living things are introduced to new places, living things are removed in others, and pollution occurs. However, when people know and care about the environment, decisions will likely be made supporting human activities that solve, or at least avoid, environmental problems.



ASSIGNMENT

Turn to your Assignment Booklet and do the assignment for Section 3.

MODULE SUMMARY

The environment has biotic and abiotic parts. Sampling methods are used to determine population sizes, and abiotic factors can be measured with thermometers, wind speed indicators, light meters, and other instruments.

Scientific study reveals the relationships of living things and their environment. Living things are connected by food webs, symbiotic relations, and niches. Living things must also be adapted to abiotic factors in order to survive.

The environment is affected by human activities. When you and everyone else are aware of the nature and extent of the impacts of human activities, environmentally friendly decisions will most likely be made.

Appendix

Glossary

Abiotic
- not biotic; non-living

Biological indicators
- organisms whose presence or absence indicates the existence of pollutants, or organisms in whose bodies pollutants are likely to be found

Biomass
- the mass of living matter in a group of organisms

Biome
- a large area of the Earth having characteristic climate, soil, and living things

Biosphere
- the region of the Earth, including the atmosphere and the oceans, in which life can exist

Biotic
- living or relating to life

Commensalism
- a relationship between two organisms (of different species) in which one obtains benefits from the other without harm or benefit to the other

Community
- interacting populations occupying the same habitat

Consumer
- an organism that eats other living things

Decomposer
- an organism that feeds on dead or waste matter

Environment
- surroundings

Extinct
- no longer existing

Extirpated
- locally extinct

Habitat
- the place or the type of place where an organism lives

Line transect
- a line of string used to estimate how plant population sizes relate to each other and to the topography

Mark-recapture method
- a method of estimating a population size by capturing, marking, and releasing a sample of the population and then capturing another sample

Micro-environment	• a small portion of an environment with its own unique abiotic conditions A micro-environment is also called a micro-habitat.
Mutualism	• a relationship between two organisms (of different species) in which each obtains benefits from the other
Niche	• the role of an organism
Parasitism	• a relationship between two organisms (of different species) in which one obtains benefits at the expense of the other
Particulates	• particles, either solid or liquid, in the air that are responsible for air pollution
Pesticide	• a substance used to destroy pests
Pollutant	• a substance harmful to living things that is released into the environment
Pollution	• the act of producing pollutants It is any activity that contaminates the environment.
Population	• the (number of) organisms of a species living in an area
Primary consumer	• an organism that eats producers
Producer	• a green plant or other organism that can produce its own food by photosynthesis
Pyramid of biomass	• a pyramid-shaped representation of the biomasses of each level of a food chain
Pyramid of numbers	• a pyramid-shaped representation of the population sizes of each level of a food chain
Quadrat sampling	• sampling that uses small plots as samples from a larger area
Range of tolerance	• the range of an abiotic factor, such as temperature and rainfall, within which a living thing can survive
Sample	• a group selected from a population randomly or a randomly selected subset of a set
Secondary consumer	• an organism that eats primary consumers

Specialization	• an adaptation of a body part for a particular habitat or niche
Symbiosis	• a relationship between two organisms (of different species) in which one obtains benefit from the other
Tertiary consumer	• an organism that eats secondary consumers

Suggested Answers

Section 1: Activity 1

1. The biotic parts are the living parts of the environment consisting of plants, animals, and micro-organisms.

2. The non-living parts are called abiotic parts.

3. Biotic components of a pond include grebes, bulrushes, pond weeds, algae, ducks, muskrats, and frogs (not all visible in the photo). Some abiotic components are water, mud, air, and light.

Section 1: Activity 2

8.

	Area A	Area B
Annual hours of sunshine	more than 2200 h	1800 - 2200 h
Annual precipitation	300 mm - 500 mm	500 mm - 800 mm
General soil type	dry-climate	wet-climate

9. You can only identify general trends between abiotic factors and types of vegetation on the map.

Textbook question 1. (a):

Grassland and parkland grow in the most amount of sunlight.

Textbook question 1. (b):

Boreal forest grows in the least amount of sunlight.

Textbook question 1. (c):

Boreal forest and parkland grow with the most amount of precipitation.

Textbook question 1. (d):

Grassland and parkland grow with the least amount of precipitation.

Textbook question 1. (e):

All types of vegetation grow in dry-climate soils.

Textbook question 1. (f):

Boreal forest grows in wet-climate soils.

10. Land near Taber would be more suitable for corn since it gets more sunshine – more than 2200 h/year compared to 1800-2200 h/year in the Peace River area.

Section 1: Activity 3

1. You may want to know population sizes in order to

   - predict the population of hawks from the population of their prey
   - determine the amount of lumber that can be harvested from the number of trees
   - estimate the crop loss due to grasshopper population

   You may have given other reasons, too, in your answer.

2. Ecologists count organisms within small *samples* in order to estimate the population size.

Section 1: Activity 4

1. The line transect method can be used.

2. Textbook question 1:

   Plant A was most common and plant B was least common.

Textbook question 3:

The two most common plants, plants A and C, grew on the same part of the slope. There are four intervals having both plants.

3. Large animals that gather in groups can be *photographed* in order to count them. Another method, used to estimate populations of small animals, is the *mark-recapture* method.

4. On day 2 you found that twelve out of sixty, or one-fifth, of the population had been marked. You could infer that seventy-five grasshoppers collected on day 1 represented one-fifth of the population. The total population must be 75 grasshoppers $\times 5 = 375$ grasshoppers.

   You could also use the formula to determine the total population.

   $$\frac{75}{\text{gh}} = \frac{12}{60}, \text{ so } \text{gh} \times 12 = 75 \times 60.$$

   $$\text{Therefore, } \text{gh} = \frac{75 \times 60}{12} = 75 \times 5 = 375.$$

   The total population must be 375 grasshoppers.

Section 1: Activity 5

2. The largest ecosystem on Earth is the *biosphere*.

3. You may have given another example but these three are given in the reading:

   - oxygen comes from tropical rainforests and from life in the ocean
   - dust and gases from a volcano are carried world-wide
   - seeds are carried from one continent to another by migrating birds

4. The polar bear and snake should take each other's place; the polar bear belongs in the cold environment and the snake in the warm one.

5. The forest biomes are the following:

   - northern coniferous forest
   - temperate deciduous forest
   - temperate rain forest
   - tropical rain forest
   - tropical deciduous forest

6. The climate gets colder and drier away from the equator.

7. Northern coniferous forest and grassland are biomes of Alberta.

8. When you compare a micro-environment to a habitat, you can say a micro-environment is smaller and has more uniform abiotic conditions. Usually the abiotic conditions of a micro-environment are different from its surrounding habitat.

Section 1: Follow-up Activities

Extra Help

1. Soil moisture, light brightness, wind speed, temperature, annual precipitation, annual hours of sunshine, and humidity are abiotic factors.

2. The caribou can be counted from aerial photographs of the herd.

3. You can use the mark-recapture method for small animals when you cannot see the whole population at the same time, e.g., for grasshoppers or for fish in a lake.

4. C a.

   D b.

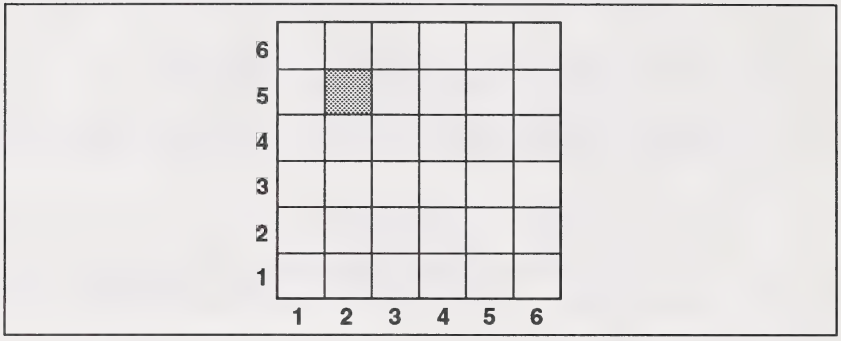
   B c.

   A d.

Section 1: Follow-up Activities

Enrichment

1. Let the first throw tell you how far across to go. The next throw can tell you how far up. For example, your throwing a 2 and then a 5 would correspond to the shaded square shown:



2. Your answer will depend on the squares you picked. The numbers of birds for your four squares should be given in a table.

3. Your estimate should be equal to nine times the total number of birds in the four squares you picked. Your estimate should be close to 359 – the actual number of birds in the photograph.

4. You should indicate the source of your information, e.g., from *Alberta Conservation and Hunter Education*, a book from Alberta Forestry, Lands, and Wildlife, from an Alberta Wildlife Officer, or from a pamphlet (which you should be able to name). You should also tell whether library research, reading, phoning, listening to a cassette, talking, or some other manner of obtaining information was used.

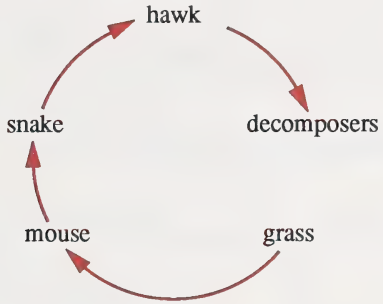
   Deer populations may be estimated using random sampling by helicopter. Statistics based on information from hunters is also used.

Section 2: Activity 1

1. The water lily produces its own food using the sun's energy. The moose eats aquatic plants. The wolf eats other mammals including some big game.

7. Organisms that feed on dead and waste material are called *decomposers*.

8. This cycle shows the movement of nutrients:



9. Bacteria and fungi serve as decomposers.

10. All the primary and secondary consumers linked to the producer you chose will have traces of the chemical. You should have these linked consumers listed. Your answer will be quite unique since you picked the producer and your own food web was used.

11. Scientists can determine food sources by

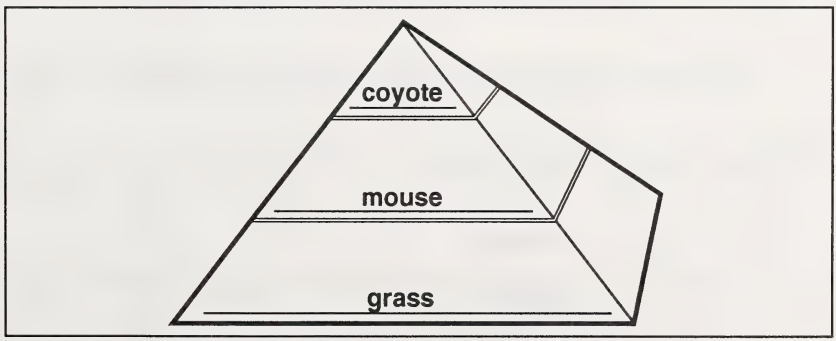
- directly observing feeding
- looking at stomach contents
- examining feces
- inferring diet from indirect evidence

12. You can infer that wolves eat caribou.

Section 2: Activity 2

1. A pyramid of numbers shows that in a food chain there are fewer primary consumers than producers, fewer secondary consumers than primary consumers, and so on.

2.



3. The biomass of the pronghorn is $50 \text{ kg} \times 95 = 4750 \text{ kg}$.

4. Caribou biomass is $800 \times 100 \text{ kg} = 80\,000 \text{ kg}$.

   Five percent of 80 000 kg is $80\,000 \text{ kg} \times \frac{5}{100} = 4000 \text{ kg}$

   Therefore, there are $\frac{4000}{50}$ wolves = 80 wolves.

Section 2: Follow-up Activities

Extra Help

1. Carbon, nitrogen, phosphorus, and calcium are *nutrients* which are needed for the growth and repair of a plant or animal. These substances are returned to the environment by way of special organisms called *decomposers*.

2. Besides nutrients organisms need *energy*, either directly from the sun or from their diet, for growth and activities.

3. Your labelled food chain should look like this:

grass	→	grasshopper	→	frog	→	hawk
producer		primary consumer		secondary consumer		tertiary consumer

4. A combination of interconnecting food chains is a *food web*.

5. The three types of symbioses are *commensalism*, *mutualism*, and *parasitism*.

6. ___b___ commensalism

   ___c___ mutualism

   ___a___ paralitism

7. The biomass of the flock is

$$900\text{ g} \times 150 = 135\,000\text{ g}$$
$$= 135\,000\text{ g} \times \frac{1\text{ kg}}{1000\text{ g}} = 135\text{ kg}$$

8. The biomass of the badgers is

$$7500\text{ kg} \times 10\% = 7500\text{ kg} \times 0.10$$
$$= 750\text{ kg}$$

9. Your prediction may be unique but you should keep in mind the following: likely a scentless skunk will become prey to a coyote or wolf. However, a skunk has sharp claws and powerful front legs so it will not be an easy mark.

10. When forests are cleared, moose lose their habitat; their food supply disappears. The moose population may move to remaining forest or the moose population diminishes. Your prediction may be different but you should support your prediction with reasons.

Section 3: Follow-up Activities

Extra Help

1. Your food chain should be like this:
alga → water mite → dragonfly larva → frog → snake

2. Pesticides *increase* as you go up the food chain.

3. You did the mould-growing experiment in Activity 3 to demonstrate resistance.

4. The sparrow, rabbit, purple loosestrife, and Eurasian milfoil are some organisms that caused problems in their new home.

5. a. The pike population goes down because the pike have less to feed on.

   b. The minnow population increases because fewer are eaten by the perch.

6. The auk became extinct due to over-hunting.

7. Loss of habitat is the main cause of extinction.

8. You might answer as follows:

   DDT has been banned, paper is being recycled, sewage is treated before being released into rivers, lead-free gasoline is used, and energy is conserved. This shows that people care about the environment. People are becoming more aware and even more concerned about the environment. This will lead to more decisions that protect the environment.

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Science 8

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